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TITLE OF THE INVENTION

Roll of a Paper/Boardmaking Machine

CROSS REFERENCES TO RELATED APPLICATIONS

[0001] This application is a divisional of U.S. App. No. 09/965,065, filed September 27, 2001, which was a continuation of PCT/FI00/00265, filed March 29, 2000, and claims priority on Finnish Application No.990702, filed March 30, 1999, the disclosures of all of which applications are incorporated by reference herein.

STATEMENT AS TO RIGHTS TO INVENTIONS MADE UNDER FEDERALLY SPONSORED RESEARCH AND DEVELOPMENT

[0002] Not applicable

BACKGROUND OF THE INVENTION

[0003] The invention relates to a method for producing a roll for a paper or board machine, and to the roll so produced.

[0004] As known from the prior art, some of the rolls in papermaking machines are made out of shell blanks by bending sheets, then after bending of the sheets the outer surface of the shell is turned on a lathe, in which connection the errors in shape caused by manufacturing inaccuracies are passed to variations in wall thickness, wherefore there arise variations in the stiffness of the shell and eccentricity of the centre of gravity of the shell with respect to its centre of rotation. The unbalance caused by the eccentricity of the centre of gravity may be minimized in the blank by proper centering and by balancing of the shell, but it is difficult to correct the stiffness variations later on. Turning causes errors in the roundness and straightness of the roll also because the blank has residual stresses and/or because the thickness of chips during machining varies. The variation of roll stiffness produces so-called semicritical vibration at a speed which is half of the critical speed of the roll. Unbalance in turn causes vibrations at all speeds.

SUMMARY OF THE INVENTION

[0005] It is an object of the invention to propose a solution to the above-mentioned problems.

[0006] In accordance with the invention, the variation of the stiffness of the shell and its need for balancing are substantially reduced because the shell body is not turned on a lathe, but, instead, after a roll blank has been produced out of a sheet by bending, the shell is first covered by a coating and turned only after this. In that connection, the errors in shape are passed to the coating as thickness variation and, as the modulus of elasticity and the density of the coating are lower than those of steel, both the variation of the stiffness and the unbalance of the shell are substantially reduced. As the coating is used, for example, in a dryer section a material that withstands high-temperature conditions. The coating is selected such as to have a low stiffness and a low density, i.e. the density and the modulus of elasticity are low. The invention can be applied to roll blanks made of planar sheets by bending as well as in connection with centrifugally cast rolls.

[0007] In accordance with the invention, the thickness of the wall is measured and its shape is determined accordingly such that the difference in stiffness is as low as possible.

[0008] The coating can be applied to the surface of the roll by rotational casting or by vulcanizing, after which the roll is machined to a desired shape and to a desired surface quality.

[0009] The invention is most suitable for use in connection with guide rolls and nip rolls having a low nip load, such as, for example, a reeling drum.

[0010] By means of the invention, improved quality and cost savings are achieved.

[0011] In the following, the invention is described in greater detail, and the benefits of the invention are also described with reference to the accompanying drawings, to the details of which the invention is, however, by no means intended to be narrowly confined.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] Figures 1A and 1B show a schematic comparison of differences in stiffness of a roll according to the invention and a roll produced by turning.

[0013] Figures 2A and 2B show a schematic comparison relating to the eccentricity of the centre of gravity when using a roll according to the invention as compared with a roll produced by turning.

[0014] Figures 3A and 3B show a schematic comparison of the principal inertias of a roll made according to the invention and a roll produced by turning.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0015] In accordance with the invention, a roll shell is bent out of a sheet blank into tubular form and its longitudinal seam is welded, and after that the shape of the tubular roll blank is measured and corrected, when needed, such that the difference in stiffness is as small as possible. After that, the roll is coated by providing, for example, by rotational casting or vulcanizing, the surface of the roll with a coating the density and the modulus of elasticity of which are considerably lower than the corresponding values of steel. The coating is machined to a desired shape and to a desired surface quality, after which the roll is ready for use and its stiffness difference and eccentricity of the centre of gravity are substantially smaller than those of a roll produced by means of known methods, as will be clear from the following series of figures and, moreover, the difference in principal inertias as a function of the diameter and the wall thickness of the roll is small.

[0016] The modulus of elasticity of the coating is 10 - 5000 MPa, preferably 10 - 4000 MPa, and its density is 0.9 - 3 g/cm^3, preferably 0.9 - 1.5 g/cm^3. The coating material is, for example, polyurethane, ebonite or an epoxy composite.

[0017] Figs. 1A and 1B show a comparison of the differences in stiffness of a roll produced in accordance with the invention and a roll produced by turning when the

out-of-roundness of the blank is 1 mm. Fig. 1A shows a roll produced according to the invention, wherein ΔI is 0.2 %, ΔI is $I_1 - I_2 / I_2 \cdot 100$ %, and I_2 is on the horizontal axis and I_1 is on the vertical axis. In the case shown in Fig. 1B, ΔI is 0.61 %. In the comparison, the diameter of the roll was 800 mm and the thickness of the wall was 35 mm. As seen in the figures, the difference in stiffness ΔI of the roll produced according to the invention is clearly smaller.

[0018] Figs. 2A and 2B show a comparison concerning the eccentricity of the centre of gravity when using the method according to the invention and a roll produced according to it or when using a roll made by turning, as known in prior art. In Fig. 2A, the eccentricity E of the centre of gravity = 0.21 mm and, in Fig. 2B, the eccentricity E of the centre of gravity = 4.83 mm. In the comparison used, the outside diameter D_u of the roll = 810 mm, the inside diameter D of the roll = 800 mm, the thickness s of the wall of the roll = 35 mm, and the eccentricity e of the blank = 1.0 mm. As seen in the figures, the eccentricity of the centre of gravity of the roll according to the invention is clearly smaller.

[0019] Figs. 3A and 3B schematically show the difference of principal inertias as a function of the diameter and the wall thickness of the roll when the out-of-roundness of the inside bore is 1 mm and the difference in per cent (%) of the principal inertias is on the Y-axis, the diameter of the roll in millimetres (mm) is on the horizontal axis and the thickness of the wall of the roll in millimetres (mm) is on the Z-axis. Fig. 3A shows the values for a roll produced according to the invention and Fig. 3B shows the values for a roll made by turning it on the outside as known in prior art. Considerably smaller differences are attained for the roll according to the invention.

[0020] As is evident from the series of figures described above, the technique according to the invention provides substantial advantages in the balance and stiffness asymmetry of the roll over the prior art arrangements.

[0021] Above, the invention has been described only with reference to some of its preferred embodiments, to the details of which the invention is, however, not by any means intended to be narrowly confined.